Conservation of Energy – Homework 1

1. Piers coasts with his car (mass = 1200kg) downhill from an altitude of 70 m to 40 m above sea level. He accelerates from 11 m/s (at 70 m) to 23 m/s (at 40 m.)
   1. What is the change in the potential energy
   2. What is the change in the kinetic energy?
   3. Why aren’t these two answers the same?
2. Jill jumps off a 3.5 m high platform with a horizontal speed of 5 m/s. Determine Jill’s speed just before she hits the ground (you don’t need Jill’s mass to solve this question.)
3. Rebecca raises a 200 g pendulum bob 22 cm vertically above the rest position. She releases the pendulum and it reaches the maximum speed at the lowest position. Find the maximum point at the lowest point assuming
   1. The pendulum is 100% efficient (all gravitational energy is converted to kinetic energy)
   2. The pendulum is 93% efficient (93% of gravitational energy is converted to kinetic energy)
4. Helena and Leon are in a mine cart as pictured below. Together they and the cart have a mass of 275 kg. They start with a speed of 12 m/s at the top of the first hill of height 100 m.

12 m/s

100 m

20 m

* 1. Find their mechanical energy at the top of the first hill
  2. What is their mechanical energy at the top of the second hill?
  3. Find their kinetic energy at the top of the second hill
  4. How fast are they travelling at the top of the second hill?
  5. Find their speed at the bottom of the hill

Answers

1. a. 3.5 x 105 J b. 2.4 x 105 J c. some energy is being lost as heat (friction)
2. 9.67 m/s
3. a. 2.07 m/s b.2.00 m/s
4. a. 2.89 x 105 J b. 2.89 x 105 J c. 2.35 x 105 J d. 41.4 m/s e. 44.3 m/s